**1001e** \$1.50



## Assembly

Line

Volume 2 -- Issue 6

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Reading Two Paddles at the Same Time.....Bob Sander-Cederlof

You may have discovered by now that if you try to read both game paddles from BASIC, there is some interaction at certain ranges. The problem is that there is only one trigger for both (really, all four) analog ports. If one of them times out long enough before the other one, you will read the tail end of the count on the second timer.

I wrote a little subroutine (see back page) which reads both paddles at once, eliminating all interaction. It also stretches the range, meaning you need a higher resistance than the standard paddles to get a full 0-255 counting range. Programs which use both paddles will run faster using this subroutine, because you get two readings in the time of one.

#### Circulation and Advertising Rates

Now that circulation is over 1000 copies per month, it seems appropriate to charge more per page for advertising than I did when there were only 100 to 200 subscribers. The new rate, effective immediately, is \$30 for a full page, \$15 for a half page.



For the first time, Amper-Magic makes it easy for people who don't know machine language to use its power. Now you can attach slick, finished machine language routines directly to your Applesoft programs in seconds! And interface them by name, not address! And pass parameters directly, just like with Applesoft commands!

You simply give each routine a name of your choice, perform the append procedure once at about 15 seconds per routine, and the machine language becomes a permanent part of your BASIC program; no more separate BLOADing programs! (Of course, you can remove any subroutine if you want to.)

Up to 255 relocatable machine language routines can be attached to an Applesoft program and then called by name. We supply over 20 machine language routines on the disk. You can enter more from magazines. And more library disks are in the works. Some routines on this disk are:

Binary file info Delete array Disassemble memory Dump variables Find substring Get 2-byte values Gosub to variable Goto to variable
Hex memory dump
Input anything
Move memory
Multiple poke decimal
Multiple poke hex

Print w/o word break Restore special data Speed up Applesoft Speed restore Store 2-byte values Swap variables

These routines and more can be attached and accessed easily. For example, to allow typing of commas and colons in a response (not normally allowed in Applesoft), you simply attach the Input Anything routine and put this line in your program:

xxx PRINT "PLEASE ENTER THE DATE. "; : & INPUT, DATE\$

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Also available from Aurora: Versacalc (several versions), The Executive Secretary and Executive Speller, Hebrew II and Hebrew II Plus, S-C Assembler, OuickTrace, Amper-Magic, The Rental Manager, F.A.R.M., The Performance Manager, Omniscan VideoDisc interface, and Flipper. DEALERS INVITED

The printer has delivered the manuals (five days early!), the bugs are exterminated, the UPS driver went back to the depot and got a bigger truck, and we are now shipping S-C Macro

Here is a brief summary of the new features the S-C Macro Assembler has that S-C Assembler II Version 4.0 did not. The highlights are of course macros, conditional assembly and the new commands EDIT. COPY and REPLACE. But they are not all!

#### Commands

COPY

There are 10 new commands:

EDIT Select a line, a range of lines, or a range of lines that contain a particular string.

Edit the lines using some of the 15

convenient sub-commands.

TEXT Write source program to disk, as a TEXT file, with or without line numbers.

REPLACE Global search and replace. Your search string can include wildcards; you can limit the search to a line, a range of lines, or search the entire program. The search can be made sensitive or insensitive to

upper/lower case distinctions. And you can select Auto or Verify mode for replacement.

Copy one or more lines from one place to another in the source code. Rearrange your

code as you please!

AUTO

Generate automatic line numbers after
every carriage return. Allows ordinary
TEXT files to be EXECed into S-C Macro
Assembler! You still can use the Version
4.0 form of automatic line numbers.

Now you have a choice!

MANUAL Turn off automatic line numbering.

SYMBOLS Print out the symbol table, in case you

missed it the first time.

MNTR Enter the system monitor (just like CALL -151 in BASIC). Of course all the Monitor commands can be executed within S-C Macro Assembler, but if you really

WANT to leave....

RST Change the Autostart Monitor RESET vector

to the specified address.

Send setup control strings to your printer.

There are also improvements in some of the older commands.

The spelling of commands is now checked. In older versions, only the first three characters were tested. The first three are still all that are necessary, but any additional letters you type must be correct. For example, LIS will list your program, and so will LIST. But, LISX will give a syntax error.

LIST and FIND now have the same syntax (in fact, they are processed by the same routine.) They may now specify either a line range, a search string, or both. The search string now requires a delimiter.

Line ranges in the LIST, FIND, COPY, EDIT, and DELETE commands may be written with a leading or trailing comma (as in Applesoft):

LIST ,2500 List from beginning through 2500. LIST 2500, List from 2500 through end.

The NEW command now restarts the automatic line numbering at 1000, rather than continuing from the last line number you entered.

The SLOW and FAST commands no longer use the Monitor output hooks at \$36 and \$37.

To leave the Macro Assembler, type FP or INT. You no longer have to also type PR#0.

After using the PR#slot command to run your printer, use PR#0 to turn it off. FAST won't do it anymore.

#### Directives

There are 7 new directives:

.MA and .EM For macro definition.

.DO expr Start conditional block.
.ELSE Toggle condition flag.
.FIN End conditional block.

.TI num, title Title and number each page of the assembly listing.

.AT string Like .AS, but the last character has the high-bit set opposite from the rest.

The .DA directive may now have a list of expressions.

The .EQ directive may now be used with local labels.

The .LIST directive has new options to control listing of macro expansions.

#### Source Entry

Control-O (Override) will allow any control character to be typed into a source line in the normal input mode or in edit mode. The control character will appear in inverse video.

The editor no longer double spaces after each line is entered.

The escape-L comment line produces one less dash, so that the line lists on the screen without a blank line after it.

Operand expressions can now include \* and / as operators, as well as + and -. The relational operators (<, =, and >) may also be used.

The tab routine has been changed to include up to five tab stops. The stop values are kept in a user-modifiable list starting at \$1010. These are the actual column numbers (not 3 less, as in version 4.0). You may use any values up to column 248.

The tab character (control-I, \$89) is kept at \$100F now, so you can change it if you like some other character better.

Any sequence of the same character repeated 4 or more times in the source code is replaced by a token \$CO, the character code, and the repeat count. (multiple blanks are still replaced by a single byte between \$80 and \$BF.) This reduces both the memory requirements and disk file size for your source programs.

If you want to shrink your source file a little, and if you have been using the Escape-L to generate comment lines that have all those dashes in them, type "EDIT" and hold down the RETURN and REPEAT keys until the entire program has been scanned. Type MEM before you do it, and after it is finished; you will probably notice a significant saving!

A parameter at location \$1017 allows the extra compression to be turned on or off. If the contents of \$1017 is \$04, compression is on. If it is \$FF, compression is off. You can experiment with this parameter to see what effect it has on program size.

#### Reference Manual

The S-C Macro Assembler comes with an all-new, 100-page manual. (At last! All the information in one place!) The manual includes chapters on source program format, commands, directives, operand expressions, macros, 6502 programming, SWEET-16, and a tutorial on using the Macro Assembler.

## QuickTrace

relocatable program traces and displays the actual machine operations, while it is running without interfering with those operations. Look at these FEATURES:

- Single-Step mode displays the last instruction. next instruction, registers, flags, stack contents. and six user-definable memory locations.
- Trace mode gives a running display of the Single-Step information and can be made to stop upon encountering any of nine user-definable conditions.
- **Background** mode permits tracing with no display until it is desired. Debugged routines run at near normal speed until one of the stopping cond-Itions is met, which causes the program to return to Single-Step.
- QUICKTRACE allows changes to the stack, registers, stopping conditions, addresses to be displayed, and output destinations for all this information. All this can be done in Single-Step mode while running.
- Two optional display formats can show a sequence of operations at once. Usually, the information is given in four lines at the bottom of the screen.
- QUICKTRACE is completely transparent to the program being traced. It will not interfere with the stack, program, or I/O.
- QUICKTRACE is relocatable to any free part of memory. Its output can be sent to any slot or to the screen.
- QUICKTRACE is completely compatible with programs using Applesoft and Integer BASICs. graphics, and DOS. (Time dependent DOS operations can be bypassed.) It will display the graphics on the screen while QUICKTRACE is
- QUICKTRACE is a beautiful way to show the incredibly complex sequence of operations that a computer goes through in executing a program

### **Q**uickTrace

\$50

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For reliability, Aurora Systems uses MAXELL diskettes only.

see these programs at participating Computerland and other

#### Assembly

Older versions of the assembler terminated assembly after finding one error. The S-C Macro Assembler keeps going, but rings the bell and prints an error message, so you know about it. If any errors are found during pass one, assembly terminates before doing pass two. At the end of assembly, the number of errors found is printed.

Typing the RETURN key during assembly will abort the assembly (even if the listing has been turned off with .LIST OFF directive).

Believe it or not, the new version assembles slightly faster than version 4.0! I measured about a 10% improvement on a large program.

All previous versions had difficulty handling forward references to variables which turned out to be in page zero. (Described on page 22 of the old blue manual.) That problem has been solved, so with S-C Macro Assembler it does not matter where you put your page-zero definitions.

#### Memory Usage

All page zero variables used by the assembler have been concentrated, so \$00 through \$1F are completely free for the user.

The standard version of the S-C Macro Assembler now occupies \$1000 through \$31FF. The symbol table starts at \$3200 and grows upward; the source code still starts at \$9600 and grows downward.

Included on the disk with the Macro Assembler is a Language Card version and a short EXEC file to load the card. This version fills the 16K RAM card from \$D000 through about \$F300. The symbol table begins at \$1000 rather than \$3200. The EXEC file configures things so that the language card contents appear to DOS as the opposite language to the one on the mother board. For example, if Applesoft is on the mother board, you type INT to get into the S-C Macro Assembler.

There are no variables within the body of the assembler. The Language Card version could be burned into ROM and placed on a firmware card, if you so desire.

#### Ordering

You can order the S-C Macro Assembler by phone or mail. We accept cash, checks, money orders, Visa, Mastercard, or COD. The price of the Macro Assembler is \$80.00. Registered owners of S-C Assembler II Version 4.0 may upgrade to the S-C Macro Assembler for only \$27.50.

FLASH! An Integer BASIC Compiler by Laumer Research 1832 School Road Carrollton, Texas 75006 (214) 245-3927

\$ 65.00 for FLASH! compiler \$ 20.00 for FLASH! Runtime Source code (runtime source code requires the FLASH! compiler and the S-C Assembler II 4.0)

- \* The FLASH! compiler runs on a 48k Apple II or Apple II Plus using DOS 3.3 and can optionally use a RAM card. To edit Integer BASIC programs, You need Integer BASIC in ROM or a language card, otherwise FLASH! does not require Integer BASIC.
- \* FLASH! compiled programs run 10-20 times faster than BASIC, and 3-6 times faster then compiled applesoft programs!
- \* At least 31 new statements and 3 new functions added to BASIC including DATA, READ, DRAW, XDRAW, HOME, NORMAL, INVERSE, FLASH, HPLOT. HGR, HGR2. CHR\$, HCOLOR=, HBACK, HFIND, TONE, NOTE, GET. 16 bit PEEKs and POKEs, hex input/output, strings to 32767 characters and more......
- \* FLASH! Can print paginated Assembly Language listings so you can see the code that FLASH! generates. Complete with full symbolic labeling for line numbers, forward references and user labels.
- \* FLASH! Can write Assembly language source files to the disk. These can be assembled with the S-C Assembler II 4.0 and the runtime source code.
- \* FLASH! can Compile disk to disk, disk to memory, memory to disk, or memory to memory.
- \* FLASH! can Position a program in memory where you want it to be. Skip over hires display buffers easily.
- \* Runtime package makes full error checks on arithmetic overflow/underflow, string and array index checks, Range checks on function calls. You have to work harder to crash a FLASH! program!
- \* FLASH! Compiled programs can run without Integer BASIC on cassette or disk based Apple II or Apple II Plus computers.
- \* Line number and symbol table listings can be printed.
- \* All answers to compiler prompt messages are checked for errors as they are entered. FLASH! is a smart compiler.

EPROM Blaster Defined......Bob Sander-Cederlof

Several readers have asked what an EPROM blaster is. This is a device, more commonly called an EPROM programmer or writer or burner, which writes data into an EPROM. The EPSON interface has an EPROM device on it, called a "2708", which can hold 1024 bytes of data or program. (Only the first 256 bytes are actually used by EPSON.) A company called Apparat advertises a card for the Apple II which will write (burn, program, blast,...) stuff into a 2708. They call their board the "Blaster".

Mountain Computer makes the ROMWRITER board for the Apple. This board can only burn single-voltage 2716 EPROMS, the Apparat board can burn 2708s, 2716s, and 2732s, whether single or multiple voltages. And ROMWRITER costs almost twice as much.

Maybe you are asking, "What on earth is an EPROM, anyway?" EPROM stands for "Erasable Programmable Read Only Memory". The "memory" part is easy: each EPROM can hold a large number of bytes of data or program. A 2708 holds 1024 bytes, 2716 holds 2048 bytes, and a 2732 holds 4096 bytes.

"Read Only" means that once the bytes are recorded, they cannot be changed. They are permanent, even if power is removed. "Programmable" means that you and I can, with a burner or blaster", record the bytes; the chip comes un-recorded from the factory. Non-programmable ROMs are recorded during manufacturing.

"Erasable" means that you can erase what you have recorded and re-use the chip. An ultraviolet lamp is used to erase the contents; I bought a \$75 EPROM Eraser from Logical Devices in Florida for the job. Maintaining the level of confusion, still other letters can be added to the acronym: EEPROMs are "Electrically" erasable; EAROMs are too (I don't know the differer e between the two, if any).

Correction to Kassel's FIFO Handler......Bill Morgan

Ever the experimenter, I started playing with Jim Kassel's FIFO Buffered Printer Handler as soon as I read about it. I learned a lot, but maybe I can spare you some difficulty with the following information.

- 1. Be aware that the three indices PBII, PBOI, and PBCC must be all cleared to zero before the first time you activate the handler.
- 2. Line 1720 was printed in AAL with a missing character. Change from

1720 LDY PRINT.SLOT.SHIFTED

to 1720 LDY #PRINT.SLOT.SHIFTED

A Review of AMPER-MAGIC......Bob Sander-Cederlof

AMPER-MAGIC is a utility program which makes it easy to add machine language subroutines to Applesoft programs and thereby extend the capabilities of Applesoft BASIC. It was written by Bob Nacon, one of our subscribers from New Jersey. For \$75, you get a 51-page reference manual; an administrative program; and a collection of 23 subroutines, to be added to your programs.

#### Why We Need It

Here are some common problems that we have all had in developing machine language routines for Applesoft:

- \* Where do you put it? You don't want to clobber Applesoft or DOS, and you don't want either of them to clobber your routines.
- \* How do you get to it? CALL? Ampersand? USR?
- \* What do you do when you want to add a second routine?
- \* How do you pass data to the subroutine, and get answers back?

Most of the time we have put all of our routines at location \$300-\$3CF because that is a free area. It works great until you need the same space for a second or third routine. We also have been using the POKE technique of placing the machine language routine at location \$300 and then calling it with CALL 768 or using the Ampersand command. This is fine for 1 or 2 routines, but you lose the full advantage of the speed of these routines waiting for them to be POKEd into memory. AMPER-MAGIC solves all of the above problems nicely.

AMPER-MAGIC hides your subroutines "underneath" your Applesoft program so that they are loaded automatically along with the Applesoft program. AMPER-MAGIC can handle 255 different subroutines of varying lengths. You can use as much space as necessary, up to the limit of memory. That solves the problem finding space for your routines.

The Ampersand ("&") command of Applesoft followed by the name of your routine is used to gain access to your subroutines. More about subroutine names later. By pointing the Ampersand vector at \$3F5-\$3F7 to the proper place, AMPER-MAGIC decodes the name of the routine desired and then transfers control to it. That solves the problem of linkage to more than one subroutine, and in a way that is human readable!

There is one limitation to the subroutines which can be used within AMPER-MAGIC: they must be fully relocatable subroutines. Without any change or reassembly they must be able to work at a new address.

Why? Because they are located at the end of your Applesoft program. As you edit your program, even just a little, the subroutines will probably move to a different address.

A fully relocatable subroutine is one which does not make any direct references to any address WITHIN the subroutine. can not be any JMP, JSR, LDA, STA, etc. to an address within the subroutine. Only relative addressing branch commands may be used within subroutines.

Many of the subroutines published within AAL this past year were not fully relocatable but they could be made so easily. Maybe I will spend some time in a future issue discussing techniques on how to make subroutines fully relocatable. Wagner, in his "Assembly Lines" column in Softalk Magazine, explained many of the motives and methods involved.

AMPER-MAGIC lets you select any name you wish for your subroutines, even for the subroutines in the AMPER-MAGIC library.

Names may be up to 4 bytes long. That is bytes, not necessarily characters. Applesoft tokenizes every command name or function name into a one byte token. Thus you can call your subroutines PRINT, INPUT, GET, etc. which only take up one byte each. A name like CLEAREOL is a legal AMPER-MAGIC name and only takes up 4 bytes (one for CLEAR, three for EOL). This allows you to name your own subroutines very descriptively for future reference.

To call a subroutine from within your program you simply use the & (Ampersand) followed by your subroutine name, followed by a "," and then your variables. The comma is not needed if there are no variables. For example: &GOTO,A\*5 or &CLEAREOL:.

The AMPER-MAGIC administrative program is a smooth operating menu driven program which prompts you all along the way. Here is how you use it:

- Load your Applesoft program.
  Put the AMPER-MAGIC diskette in a drive and type EXEC AMPER-MAGIC. (Specify slot and drive if not the same as the last accessed one.)
- Fill in information after the prompts, as required.

By following the menu and the well-written documentation, you can add, change, delete, and rename any subroutine in your program. You may add or delete any number of subroutines in one session.

You can load a subroutine directly from the keyboard in either decimal or hex. Thus many of the routines published in AAL can just be typed directly into AMPER-MAGIC.

#### MICRO MART

BOX 12021 DA	ALLAS, TX 75225 PRODUCTS FOR APPLE II (tm.)	(214) 36	1-7831
ITEM .	PRODUCTS FOR APPLE II (tm)	LIST	PRICE
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MC I - 0 0 7 0 MC I - 1 0 7 0 MC I - 0 0 4 0 MC I - 1 0 4 0 MC I - 1 0 3 5	MICRO SCI - A70 DISK DRIVE w/ontr A70 DISK DRIVE wo/ontr (70 track, 5-1 A40 DISK DRIVE w/ontr (40 track, 5-1/ A40 DISK DRIVE wo/controller A35 DISK DRIVE wo/controller	/4") 4")	599 519 469 389 409
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If you have subroutines already assembled on disk, you simply tell AMPER-MAGIC the file names watch it work. AMPER-MAGIC makes room in the subroutine table at the end of your program, and loads the subroutine into your program. Really neat! Everything is handled automatically except for the subroutine name, which you must supply.

There isn't enough room here to describe all the other functions available, but suffice to say that AMPER-MAGIC gives you all the administrative functions you need to selectively add or delete any subroutines from your program easily and quickly.

Once you have finished with AMPER-MAGIC you simply EXIT via the menu. AMPER-MAGIC returns all your program pointers to their previous state, and clears itself out. Your program has now been modified and you can run it to check out the new subroutine. If you need to make further changes, just EXEC AMPER-MAGIC again.

The AMPER-MAGIC program alone is probably enough to justify its purchase, but you also get 23 ready to use subroutines. Some of these were originally published right here in AAL. Bob Nacon modified them wherever necessary to make them fully relocatable.

Here is a list of some of the subroutines on the disk:

&FIND,v\$,v\$,v Find a substring in a string.
&DARY,v Delete an array.
&GET,v,v PEEK a two-byte value.
&GOSUB,v GOSUB to a variable line.
&GOTO,v GOTO to a variable line.
&INPUT,v\$ Input a line containing even commas, quotation marks, or colons.

The ones listed above only give you the flavor. Remember, there are 23!

One of the best features of all of these subroutines is that all information is passed to and from the subroutines via variables, just like regular commands. No peeking or poking to set up parameters. This is a very professional touch, and makes the subroutines truly useful.

Each subroutine is described in detail, with all the information and examples you need to use them effectively.

As you can probably tell, I like this program. It provides all of us an easy way to add all those neat routines we have been working on, or wanting to work on, and never had a good way of accessing them.

AMPER-MAGIC is available from your local dealer or from AURORA Systems Inc., Madison, WI 53704.

More About the EPSON Interface......Peter Bartlett

Whoops! I left out something in my instructions for modifying the EPSON interface card!

The software driver on the interface card is \$100 bytes long, and resides in the first 256 bytes of the 1024-byte EPROM. However, the folks at EPSON got a couple of the address lines mixed up. Burning a new EPROM is not as straightforward as it should be.

The problem is that chunks of the program are shuffled. To understand, consider the \$100 bytes to be divided into 4 parts of \$40 bytes each. Part 0 is \$0 to \$3F, part 1 is \$40 to \$7F, part 2 is \$80 to \$BF, and part 3 is \$C0 to \$FF. When blasting the EPROM, the sequence of these parts must be changed. Instead of 0.1.2.3, the sequence must be 1.0.3.2.

When you list the contents of the EPROM while it is in the EPSON card, the contents appear normal. But if you remove the EPROM from the card and read it with another device, it will be in its juggled format.

Another point worth emphasizing is that this fix does not allow characters with the high-bit set to pass through the normal software driver. This driver is only compatible with the Apple's normal ASCII output. However, both Applesoft and machine language programmers can send 8-bit characters by bypassing the card as described last month in my article.

## Time II

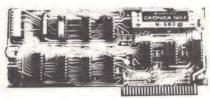
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The Other EPSON Manual -- A Review.....Bob Sander-Cederlof

If you have an EPSON MX-80 printer tied to your Apple (who doesn't), you probably share the frustration of trying to learn how to use it with a manual aimed at Radio Shack TRS-80 owners. Bill Parker decided to do something about it.

Bill studied, analyzed, experimented, and perspired; then he wrote the key facts down in Apple-oriented English. With description and sample program listings he shows you how to:

- 1. Use all 12 print modes (emphasized, double width. etc.).
- 2. Underline.
- 3. Use subscripts and superscripts.
- 4. Set half-spacing, double-spacing, etc.
- 5. Do formfeeds, vertical tabs, etc.
- 6. Use horizontal tabs.
- 7. Use the printer commands inside a word processor.
- Do some special tricks through the parallel interface card (true underlining, single-word emphasis, etc.).

The book(let) is 8-1/2 by 11. 17 pages, bound with a plastic comb. Not elegant, but sufficient; and anyway, it is the information he is selling. The price is \$4.98, postpaid, from Bill Parker. Cut The Bull Software, P. O. Box 82761, San Diego, CA 92138.

#### ATTENTION MX-80 OWNERS!

Are you frustrated by all those great programmable features on your MX-80 printer? Mould you like to make use of the various font combinations but can't remember the commands? Are you annoyed that your MX-80 doesn't skip over the perforation? Mould you like your hard copy output documented with a title, date and page number? If your answer to these questions is YES, then read on.

#### INTRODUCTING THE MX-80 FORMATTER ROM

Now you can easily obtain full control of your printer. The MX-80 Formatter program is contained in ROM so its always on-line. It provides a convenient method for manually setting the MX-80 to the configuration YOU want without the need for special disk-based software drivers. This printer utility is user-friendly and simple to operate. A printer attributes list clearly displays the current command status. Changes to printing fonts, line length, forms length, date, title, etc are easily performed.

The Formatter ROM is currently configured for use with MX-80 or MX-80FT printers with GRAFTRAX. Requires an APPLE II or APPLE II Plus with either an Epson, Tymac or equivalent parallel printer interface card. Formatter ROM plugs directly into either Mountain Computer's RomPlus board or DataShift's MiniRom board (SPECIFY with your order which ROM board you are using since their formats are different).

MX-80 Formatter ROM: \$29.00
Avoid A \$3.00 Shipping/Handling Charge By Mailing Full Payment With Order

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UTIL-DS is a set of routines for use with Applesoft to format numeric output, selectively clear variables (Applesoft's CLEAR gets everything), improve error handling, and interface machine language with Applesoft programs. Includes a special load routine for placing machine language routines underneath Applesoft programs. \$25 Disk, Applesoft.

SPEED-DS is a routine to modify the statement linkage in an Applesoft program to speed its execution. Improvements of 5-20% are common. As a bonus, SPEED-DS includes machine language routines to speed string handling and reduce the need for garbage clean-up. Author: Lee Meador.

\$15 Disk, Applesoft (32K, ROM or Language Card).

#### (Add \$4.00 for Foreign Mail)

\*Apple II is a registered trademark of the Apple Computer Co.

Tricky Code that Always Skips.....Bob Sander-Cederlof

All microprocessors have an instruction which does nothing, usually called "NOP". The 6502 is no exception.

In spite of appearances, an instruction which does nothing can be quite useful. However, this article is about another kind of instruction, which does ALMOST nothing.

Some microprocessors have this kind, which do nothing except skip over one or more bytes. That is, they act like a very short forward jump. The advantage over using an actual jump or branch instruction is in memory saved. Relative branches on the 6502 take two bytes of memory; jumps take three. A skip-one or skip-two instruction would take only one byte, IF the 6502 had such.

IF? Well, you certainly do not see an instruction like this among the 56 in any of the books, do you?

However, if you disassemble things like DOS. Applesoft ROMs, and printer interface ROMs, you will find tricky ways to skip with only one byte. For example, in many Apple printer interfaces, the first three bytes look like this:

C100- 18 CLC C101- B0 38 BCS \$C13B

Now isn't that silly: to clear carry, and then to use BCS to branch if it is not clear!? No, the BCS is just being used to skip over the \$38 stored in \$C102. If you enter the code at \$C102, that \$38 is a SEC instruction. Thus, depending on whether you entered at \$C100 or \$C102, carry is clear or set respectively. The BCS opcode byte is being used as a skip-one opcode.

Another kind of skip is found in various places inside your Apple. You might find the BIT instruction used this way. In fact, it seems to me that I run across BIT being used as a skip-one or skip-two instruction more often than I see it used to test bits! Here is an example from Applesoft ROMs:

E196- A2 78 LDX \$\$6B "BAD SUBSCRIPT" MSG E198- 2C A2 35 BIT \$35A2 TRICK: BIT SKIPS OVER 2 E19B- 4C 12 D4 JMP \$D412 PRINT ERROR MESSAGE

The code should really look like this:

E196- A2 78 LDX \$\$6B "BAD SUBSCRIPT" MSG E198- 2C .HS 2C SKIP NEXT TWO BYTES E199- A2 35 LDX \$\$35 "ILLEGAL QUANTITY" MSG E19B- 4C 12 D4 JMP \$D412 PRINT ERROR MESSAGE

You have to be a little careful about what you skip over. The BIT instruction is actually executed, and so status flags Z, N, and V are possibly changed. Also, the two bytes skipped over represent a memory address to the BIT opcode; that memory

location will be accessed. No problem, unless it just happens to be an address in the range of the I/O addresses (from \$C000 to \$CFFF). If it does, something strange might occur, like turning on a disk drive....

If you remember my article about the "So-Called Unused Opcodes", from about a year ago, there are some REAL skip-one and skip-two instructions. They do not modify any status bits, and they do not reference any memory addresses. I would recommend using ".HS 3C" rather than ".HS 2C" for this reason. "3C" is not a defined or supported opcode, but it apparently is built-in to all existing 6502's. (No guarantee here...test your own before you make a big commitment.)

If you want to skip only one byte, you can use the other BIT form (\$24); it works on a zero page address, which will not bother any I/O addresses. If you don't want to modify any status bits, try ".HS 34".

OFTEN WONDER HOW MACHINE LANGUAGE PROGRAMS WORK?
Well stop wondering and do something about it! Use DISASM to convert 6502 machine code into meaningfull, symbolic source. Create a text file which is directly compatable with DOS ToolKit, LISA and S-C (both 4.0 & Macro) Assemblers. DISASM handles data tables, displaced object code and even lets you substitute MEANINGFUL labels of your own choice (100 commonly used Monitor & Pg lero names included in Source form to get you rolling). An address-based cross reference table provides even more insight into the inner workings of machine language programs. DISASM is an invaluable aid for both the novice and expert alike.

DISASM (Version 2.2): \$30.00

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Each Of The Above Programs Is Supplied In 3.3 DOS Format Unless Otherwise Requested. A Detailed User's Manual Is Included. All Programs Are In Machine Language And Run On Either An APPLE II or APPLE II PLUS.

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\*\*\*\* SAY YOU SAM IT IN 'APPLE ASSEMBLY LINE' \*\*\*\*

Using the Applied Engineering Time II.....Bob Sander-Cederlof

You have probably noticed Dan Pote's ad in this and previous issues of AAL. I finally got one of his clock-calendar cards, and learned how to program it.

A disk full of sample programs comes with the board, but none of them were exactly what I wanted. I wanted a simple, short program to read the time and date and display it on the screen; and I wanted some patches to DOS 3.3 which would append the date in MM/DD/YY format to any files SAVEd or BSAVEd.

The clock already had the correct time and date set when it arrived in the mail. The onboard rechargeable battery keeps the circuit running even when you remove the card from your computer! A couple of times I stopped the clock when I was working on my programs, so I just used one of the time-setting programs on the disk to correct the time.

How do you read the time and date? There are 13 registers on the board. Each register holds one digit of the time and date information. To read a particular register, you store the register number into the clock input port, and then read the clock output port.

In order to avoid reading the time or date while it is being changed, you momentarily stop the clock before reading, and restart it when you are finished. You don't want to keep the clock stopped for more than one second, or it will lose time. After stopping the clock, you have to wait at least 150 microseconds before reading it. If the clock was updating when you stopped it, the delay allows the update in progress to complete.

The following program reads the time and date and writes it on the bottom line of the screen.

				1010							
				1020	*	REAI	DATE	FROM C	LOCK	IJ	[
0050- C080-				1030 1040 1050 1060	SLOT	.EQ	\$50 \$C080	SLO	T# *	16	5
0800- 0802- 0804-	ΔO	10	СО	1070	READ	LDA	#SLOT #\$10 CLOCK	HOL	D CL	ock	· <b></b> -
0804- 0807- 0809- 080C-	AO B9 F0	00 3D 1F	08	1100 1110 1120	.1	LDA	CLOCK- #0 MAP,Y -3	MEA	T DV	TE Map	
080E- 0810- 0813-	30 29 29	17 82 25	CO	1130 1140 1150		BMI STA CMP	CLOCK-	END COP +2,X IS NO	Y CH SE IT H	ARA LEC OUR	CTER T REGISTER :TENS?
080E- 0810- 0813- 0815- 0817- 0816- 081E- 0820-	BD 29	82 03 07	CO	1170 1180 1190				+2,X	YΕ		FLAGS
081E- 0820- 0822-	A9 D0 BD	ÃÓ 05 82	CO	1200 1210 1220	. 4	LDA BNE LDA	#3 #\$A0 CLOCK-	+2.¥···	ALWA RE	YS AD	, REGISTER
0822- 0825- 0827- 082A-	09 99 C8	BO DO	07	1230	.5	ORA STA INY	#\$BO BUFFEI	+2,X CON R,Y	VERT	TO	ASCII
082B-	D0	DC		1260		BNE	.1		ALWA	YS	

```
082D- A9 00 1270
082F- 9D 81 C0 1280
0832- AD 00 C0 1290
0835- 10 C9 1300
0837- 8D 10 C0 1310
                         1270 .3
                                            LDA #0
                                                                 RELEASE CLOCK
                                            STA CLOCK+1.X
                                                                 SEE IF KEY PRESSED
                                            LDA $COOO
                                            BPL READ
                                                                 NO. KEEP READING
YES. CLEAR STROBE
                                            STA $C010
              SE FD
                        1320
1330
                                                                 LINEFEED AND RETURN
083D- 2A 29 AF
0840- 28 27 AF
0843- 2C 2B AO
0846- AO 25 24
0849- BA 23 22
084C- BA 21 20
                         1340 MAP
                                            .HS 2A29AF2827AF2C2BA0A02524BA2322BA212000
                        07D0-
```

My Time II card is in slot 5. It will work in any slot from 1 to 7. Change line 1040 if you use a different slot. There are two addresses used to talk to the Time II card: \$C081+slot\*16, and \$C082+slot\*16. For slot 5, these are \$C0D1 and \$C0D2. Line 1070 loads "slot\*16" into the X-register, so that loads and stores into the Time II registers will be directed to the proper slot.

Lines 1080.1090 stop the clock. Storing any value at \$COD1 of the form xxxlxxxx will stop the clock. If bit 4 is a zero the clock will be started again, as in lines 1270.1280.

Lines 1100-1260 read the date and time and store them on the screen. The reading is under the control of a format map, line 1340. The format map contains three kinds of bytes: 00, meaning the end of the map; 2x, register addresses; and ASCII characters with the high bit set. The Y-register indexes access to the map, and also the corresponding position on the screen line.

Lines 1110-1130 get the next map byte, and analyze it. If it is 00, the time and date have been read; then lines 1270-1320 restart the clock and test if you want to keep reading or not. If the byte is negative, then it is an ASCII character; Line 1240 stores the character on the screen line, and reading continues. If neither zero nor negative, the byte is a register address. Line 1140 selects the register by storing its address at \$COD2.

Lines 1150-1230 read the selected register. If the register was the tens-digit of the hour, then the flag bits are removed. These flag bits indicate whether you are using 12-hour or 24-hour format in the Time II, and AM/PM status. I didn't care, so I just mask them out. I also replaced a leading zero digit with blank here. Line 1230 converts the digit to an ASCII character.

Lines 1290-1320 test whether you have pressed any key on the keyboard. If not, reading continues. If you did, the storbe is cleared and the program terminates after printing a carriage return.

Here is a summary of the clock register addresses:

```
tens units
                21
                     20
Seconds
                23
                      22
Minutes
Hours
                25
                     24
                           with 12/24 and AM/PM flags
Day of Week
                      26
Day of Month
                28
                      27
Month
                2 A
                      29
                2C
                     2B
Year
```

The second program I wrote only reads the date. The actual reading is very similar to the first program, but the purpose is different. Instead of displaying it on the screen, I store in in the last 8 positions of the primary file name buffer inside DOS 3.3. The patches in lines 1040-1140 set up SAVE and BSAVE to call my program before opening the file. My program then modifies the file name to include the current date as the last 8 characters.

```
1010 #-
                       1010 **
1020 *
1030 *
1040
1050
                                         PUT DATE ON ALL NEW FILES
                                         .OR $A33F
                                                             IN BSAVE COMMAND
                                         JSR PATCH
A33F- 20 B3 B6
                       1070
                                         .OR $A3A5
                                                             IN SAVE COMMAND
                       1090
                                         jšr patch
A3A5- 20 B3 B6
                       1120
                                         OR $A3BE
                                                             IN SAVE COMMAND
                       1140
                                         JSR PATCH
A3BE- 20 B3 B6
                       1150
0005-
                       1160
                                         .EQ 5
.EQ SLOT#16+$C080
                       1170
                              CLOCK
                       1180
                        1190
                                         .OR $B6B3
                       1200
                       1210 PATCH
B6B3- 48
B6B4- A9 10
B6B6- 8D D1 C0
                       1220
1230
1240
                                         PHA
                                         LDA #$10
                                                             HOLD CLOCK
                                         STA CLOCK+1
B6B9- A0
B6BB- 88
             20
                       1250
1260
                                         LDY #32
                                                             DELAY 150 MICROSECONDS
WHILE HOLD TAKES EFFECT
                                         DEY
B6BC- D0 FD
                                         BNE . 1
B6BC- DO FD
B6BE- AO 07
B6CO- B9 DC B6
B6C3- 30 08
B6C5- BD D2 C0
B6CB- AD D2 C0
B6CB- 09 B0
B6CD- 99 88 AA
                       1280
1290
1300
1310
                                                             MOVE 8 CHARS
NEXT BYTE FROM MAP
COPY CHARACTER
                                         LDY #7
LDA MAP,Y
                                         BMI
                                         BMI .3
STA CLOCK+2
                                                                     SELECT REGISTER
                       1320
1330
1340
1350
                                                             READ REGISTER
CONVERT TO ASCII
IN LAST 8 CHARS OF PRIMARY FNB
                                         LDA CLOCK+2
                                         ORA #$BO
STA $AA8B,Y
                               • 3
                                         DEY
                       1360
B6D1- 10 ED
                                         BPL .2
LDA #0
                                                             LOOP UNTIL ALL 8 CHARS MOVED
B6D3- A9 00
B6D5- 8D D1 C0
B6D8- 68
                                                             RELEASE CLOCK
                       1380
                                          STA CLOCK+1
                                                             CONTINUE AFTER PATCH
B6D9- 4C D5 A3
                       1400
                                         JMP $A3D5
                        1410
B6DC- 2A
B6DF- 28
             29
27
B6E2- 2C 2B
                       1420 MAP
                                          .HS 2A29AF2827AF2C2B
```

I located the program inside a hole in DOS 3.3 (\$B6B3-\$B6FD). If you are already using a modified DOS, this hole may already have some code in it, so be careful. For example, the DOS on Applied Engineering's disk IS modified, and the modification uses this same space.

When you assemble this program, the four .TF directives write four short little binary files (B.1, B.2, B.3, and B.4). I wrote a four line EXEC file to BLOAD these four binary files, installing the patches.

The program saves the contents of the A-register at line 1220, and restores A at line 1390. Lines 1230,1240 stop the clock so we can read it. Lines 1250-1270 delay for about 150 microseconds in case the clock was updating when I stopped it.

Lines 1280-1360 read the date under control of a format map in line 1420, almost the same way the first program did. This time I used the known length of 8 bytes to terminate the loop, rather than a final 00 byte. Line 1340 stores inside the DOS primary file name buffer (\$AA75-\$AA92).

Lines 1370-1380 turn the clock back on. Line 1390 restores the A-register, and line 1400 continues with the normal DOS 3.3 code.

Before arriving at the above technique, I tried several others. I had one working which patched the DOS File Manager instead of the SAVE and BSAVE commands. This version appended the date to the name of any and all new files created. It worked exactly as it should, but it would have caused many problems with existing programs. Many Applesoft and Integer BASIC programs using TEXT files use an OPEN-DELETE-OPEN-WRITE sequence to make sure that a new file is used for output. If my patch to the file manager was installed, this sequence would not work correctly anymore. Therefore I elected to go the more direct route, only dating SAVE and BSAVE files.

If you want to use the date on TEXT file names, you could append it to the file name using normal string concatenation techniques.

I have not used any other of the clock/calendar cards available for the Apple, but I am convinced the Time II from Applied Engineering is a good one. (It may also be the least expensive.) The circuit card is professionally done; the components are highest quality; it works when you plug it in. There are other features, such as interrupt capability, which I have not yet explored. If you have any use for a clock/calendar. I recommend this one.

6502 Assembly Language Subroutines, by Lance Leventhal and Winthrop Saville, is a book all of you will want. Specs: 550 pages, 7-1/2 by 9-1/4 inches, paperback, \$12.99 from Osborne/McGraw-Hill. I'll send you a copy for \$12 plus \$2 shipping (it weighs two pounds!). Naturally, shipping will be more if you live outside the USA.

Ouoting from the back cover:

"If you want to use a specific assembly language routine, learn assembly language quickly, or improve your programming skills, 6502 Assembly Language Programming is for you. It provides code for more than 40 common 6502 subroutines, including code conversion, array manipulation, arithmetic, bit manipulation, string processing, input/output, and interrupts. It describes general 6502 programming methods (including a quick summary for experienced programmers), and tells how to add instructions and addressing modes [using several instructions in sequence, subroutines, or macros]. It even discusses common 6502 assembly language programming errors."

All of the subroutines are thoroughly documented, making it easy to understand how they work, and how to use them. The subroutines are useful in the Apple with no changes, other than those required to interface to your own programs. Some of the subroutines even reference the Apple monitor ROMs!

The first five copies I bought were gone within three hours of their arrival, so I ordered 20 more. Want one?

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```
1000 #
                             1010 #
                                                   READ BOTH GAME PADDLES AT THE SAME TIME
                             1020
1030
1040
1050
1060
                                     MON.CH .EQ $24
PDLO .EQ $C064
PDL1 .EQ $C065
PDL.S .EQ $C070
KEYBGARD .EQ $C000
 0024-
 C064-
C065-
 C070-
                             1070
 0800- 20
0803- 98
0804- 20
                  1A 08
                             1090
                                      TEST
                                                   JSR READ.BOTH.PADDLES
TYA (Y) = PDL
                              1100
                                                                                                 SETTING
                                                                            PRÍNT IN HEX ON SCREEN
                 DA FD
                             1110
                                                    JSR
                                                          $FDDA
 0807-
0809-
080A-
080D-
                                                                           SPACE BETWEEN VALUES
(X) = PDL 0 SETTING
PRINT IN HEX ON SCREEN
                 24
            E6
                                                    INC MON.CH
                              1120
                                                   TXA
JSR $FDDA
LDA #0
                             1130
           20 DA
A9 00
85 24
AD 00
10 EA
8D 10
                 DA
00
24
                      FD
                              1150
                                                                            HTAB 1
 080F-
0811-
0814-
0816-
0819-
                               160
                                                    STA MON.CH
LDA KEYBOARD SEE IF ANY KEY PRESSED
                             1170
1180
                 ōo co
                                                   LDA REIBUARD SEE IF ANI REI FRESSED
BPL TEST NO KEYPRESS, KEEP READING PADDLES
STA KEYBOARD+16 CLEAR KEYBOARD STROBE
                       CO
                             1190
                              1200
                                                    RTS
                                                                           RETURN
                              1210
                                      READ.BOTH.PADDLES
LDX #0
LDY #0
                             1220
 081A- A2 00
081C- A0 00
                                                                            PADDLE O COUNT
                              1240
                                                                           PADDLE 1 COUNT
START THE PADDLE TIMERS
CHECK PADDLE 0 TIMER
 081E- AD
0821- AD
                             1250
1260
1270
1280
                 70
64
                       CO
                                                    LDA PDL.S
            AD
10
                       ČĎ
                                                    LDA PDLO
                                       .1
 0824-
                  ŎĎ
                                                    BPL .2
                                                                            TIMED OUT
0824- 10
0826- E8
0827- AD
082C- C8
082D- D0
082F- A2
.0831- D0
                                                    INX
                                                                            COUNT PDLO
CHECK PADDLE 1
                             1290
1300
1310
1320
1330
1340
                 65
17
                       CO
                                                    LDA PDL1
                                                    BPL
                                                                            TIMED OUT
                                                    INY
                                                                            COUNT PDL1
                 F2
FF
                                                    BNE .1
LDX #255
BNE .3
DLE 0 TIMED
                                                                            AGAIN
                                                                            MAX TIME FOR BOTH PADDLES
                                                                         ...ALWAYS
OUT, KEEP LOOKING AT PADDLE 1
CHECK PADDLE 1
                  0C
                             1350
1360
1370
1380
1390
                                             -PADDLE
 0833- AD
0836- 10
0838- C8
0839- EA
083A- EA
083B- EA
083C- EA
083F- AO
0841- DO
                  65
19
                                                    LDA PDL1
                      CO
                                       .2
                                                                           TIMED OUT
COUNT PDL1
EQUALIZE TIMING
                                                    BPL
                                                    INY
                                                    NOP
                             1410
1420
1430
                                                    NOP
NOP
                 F4
                                                    BNE
                                                                            MAX TIME FOR PDL1
                              1440
                                                    LDY #255
                 FF
                                       .3
                                                                         OUT, KEEP LOOKING AT PADDLE 0 CHECK PADDLE 0
                              1450
1460
                  0E
                                              BNE .5
PADDLE 1 TIMED
 0843- AD
0846- 10
0848- E8
0849- EA
                             1470
1480
                  64 CO
                                                    LDA PDLO
                  09
                                                    BPL
                                                                            TIMED OUT
                                                                            COUNT PDLO
                              1490
                                                    INX
                              1500
                                                                            EQUALIZE TIMING
                                                    NOP
                             1510
1520
1530
1540
1560
                                                    NOP
 084B- EA
084C- EA
                                                    NOP
                                                    NOP
 084D- D0
084F- A2
                                                                            KEEP CHECKING
MAX TIME FOR PDLO
                 F4
                                                    BNE
                                                           #255
                                                    LDX
                 FF
 0851- 60
                                                                            RETURN TO CALLER
 0000 ERRORS IN ASSEMBLY
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